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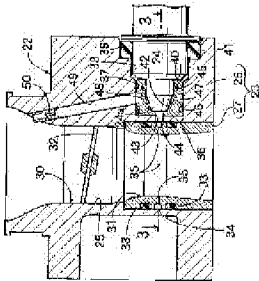
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(54) FUEL SUPPLY DEVICE FOR ENGINE



(57)Abstract:

PROBLEM TO BE SOLVED: To further accelerate fuel atomization, in a fuel supply device for engines, in which a fuel injection valve is secured to an intake passage forming body forming the intake passage, and which is provided with a fuel passage for introducing the fuel from the fuel injection valve, a fuel suction port, with one end communicated with the fuel passage and the other end communicated with the intake passage, and an air bleed passage with one end communicated with the intake passage at the upperstream side of the fuel suction port and the other end communicated with the fuel passage.

SOLUTION: The fuel suction port 35 is opened to the intake passage 30 in the direction orthogonal to air flow orthogonal to the intake passage 30.

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CLAIMS

[Claim(s)]

[Claim 1] The fuel path to which the inhalation-of-air way organizer (23) which forms the inhalation-of-air way (30) which leads to an air cleaner (29) is equipped with a fuel injection valve (24), and the fuel from said fuel injection valve (24) is led (34), Fuel extrusion opening which makes the other end lead to said inhalation-of-air way (30) while making an end lead to this fuel path (34) (35), The air-bleed path (49) which made the other end lead to said fuel path (34) while making an end lead to an inhalation-of-air way (30) by the upstream from said fuel extrusion opening (35) The fuel supply system of the engine characterized by carrying out opening to said inhalation-of-air way (30) towards intersecting perpendicularly with the airstream to which the

other end of said fuel extrusion opening (35) circulates said inhalation-of-air way (30) in the fuel supply system of the engine prepared in said inhalation-of-air way organizer (23).

[Claim 2] The fuel supply system of the engine according to claim 1 characterized by for said fuel extrusion opening (35) carrying out opening to the inner skin of an inhalation-of-air way (30), and preparing it in an inhalation-of-air way organizer (23).

[Claim 3] The fuel supply system of the engine according to claim 2 characterized by carrying out opening of the other end of two or more of said fuel extrusion openings (35) to the inner skin of said inhalation-of-air way (30) in the location which countered mutually.

[Claim 4] The fuel path to which the inhalation-of-air way organizer (23) which forms the inhalation-of-air way (30) which leads to an air cleaner (29) is equipped with a fuel injection valve (24), and the fuel from said fuel injection valve (24) is led (34), Fuel extrusion opening which makes the other end lead to said inhalation-of-air way (30) while making an end lead to this fuel path (34) (35), The air-bleed path (49) which made the other end lead to said fuel path (34) while making an end lead to an inhalation-of-air way (30) by the upstream from said fuel extrusion opening (35) In the fuel supply system of the engine prepared in said inhalation-of-air way organizer (23) From the inhalation-of-air way (30) of the upstream of this converging section (31), the converging section (31) which constitutes said a part of inhalation-of-air way (30) makes an inner circumference diameter small, and is formed in said inhalation-of-air way organizer (23). The fuel supply system of the engine characterized by carrying out opening of the other end of said fuel extrusion opening (35) to the inner skin of said converging section (31) towards intersecting perpendicularly with the airstream which circulates said converging section (31).

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] The fuel path to which the inhalation-of-air way organizer which forms the inhalation-of-air way where this invention leads to an air cleaner is equipped with a fuel injection valve, and the fuel from said fuel injection valve is led, Fuel extrusion opening which makes the other end lead to said inhalation-of-air way while making an end lead to this fuel path, The air-bleed path which made the other end lead to said fuel path while making an end lead to an inhalation-of-air way by the upstream rather than said fuel extrusion opening is related with the fuel supply system of the engine prepared in said inhalation-of-air way organizer.

[0002]

[Description of the Prior Art] Conventionally, this fuel supply system is already known for JP, 5-26132, A etc.

[0003]

[Problem(s) to be Solved by the Invention] By the way, such a fuel supply system makes it unnecessary to control the fuel-injection timing of a fuel injection valve with high precision while making it possible to promote atomization of a fuel with the assistant air from an air-bleed path, and to reduce the injection pressure of a fuel injection valve, while sucking out and atomizing the fuel supplied from a fuel injection valve by the airstream which circulates an inhalation-of-air way. however -- in the above-mentioned conventional thing, opening of the fuel extrusion opening is carried out towards the flow direction downstream of the airstream in an inhalation-of-air way, and atomization of the fuel in the inside of airstream is good -- saying -- hard -- reduction of fuel consumption, and exhaust air -- in order to aim at the improvement and the improvement in engine power in description, to promote atomization of a fuel further is desired.

[0004] This invention is made in view of this situation, and aims at offering the fuel supply system of the engine which enabled it to promote atomization of a fuel further.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 The fuel path to which the inhalation-of-air way organizer which forms the inhalation-of-air way which leads to an air cleaner is equipped with a fuel injection valve,

and the fuel from said fuel injection valve is led, Fuel extrusion opening which makes the other end lead to said inhalation-of-air way while making an end lead to this fuel path, In the fuel supply system of the engine with which the air-bleed path which made the other end lead to said fuel path while making an end lead to an inhalation-of-air way by the upstream rather than said fuel extrusion opening is established in said inhalation-of-air way organizer The other end of said fuel extrusion opening is characterized by carrying out opening to said inhalation-of-air way towards intersecting perpendicularly with the airstream which circulates said inhalation-of-air way.

[0006] while becoming possible to reduce fuel consumption by airstream and the fuel sucked out of fuel extrusion opening at an airstream side colliding mutually, a fuel being atomized effectively, and atomization of a fuel being promoted by carrying out opening towards the airstream of an inhalation-of-air way and fuel extrusion opening crossing at right angles according to the configuration of such invention according to claim 1 -- exhaust air -- it becomes possible to improve description and engine power.

[0007] moreover, invention according to claim 2 -- the configuration of invention of the claim 1 above-mentioned publication -- in addition, it is characterized by for said fuel extrusion opening carrying out opening to the inner skin of an inhalation-of-air way, and preparing it in an inhalation-of-air way organizer, and according to this configuration, the structure which bars flow is not established in an inhalation-of-air way with arrangement of fuel extrusion opening, increase of ventilation resistance can be avoided, and engine power can be improved further.

[0008] Are characterized by carrying out opening of the invention according to claim 3 to the inner skin of said inhalation-of-air way in the location where the other end of two or more of said fuel extrusion openings countered mutually in addition to the configuration of invention of the claim 2 above-mentioned publication, and according to this configuration By making the fuels sucked out of fuel extrusion opening which countered mutually at the airstream side collide if a fuel can be atomized much more effectively and fuel consumption is reduced further, preventing that a fuel adheres to the inner skin of an inhalation-of-air way, while ** will become possible -- exhaust air -- description and engine power can be improved further.

[0009] The fuel path to which the inhalation-of-air way organizer which forms the inhalation-of-air way where invention according to claim 4 leads to an air cleaner is equipped with a fuel injection valve, and the fuel from said fuel injection valve is furthermore led, Fuel extrusion

opening which makes the other end lead to said inhalation-of-air way while making an end lead to this fuel path, In the fuel supply system of the engine with which the air-bleed path which made the other end lead to said fuel path while making an end lead to an inhalation-of-air way by the upstream rather than said fuel extrusion opening is established in said inhalation-of-air way organizer The converging section which constitutes said a part of inhalation-of-air way makes an inner circumference diameter smaller than the inhalation-of-air way of the upstream of this converging section, it is prepared in said inhalation-of-air way organizer, and the other end of said fuel extrusion opening is characterized by carrying out opening to the inner skin of said converging section towards intersecting perpendicularly with the airstream which circulates said converging section.

[0010] By carrying out opening to the inner skin of a converging section towards the airstream of an inhalation-of-air way and fuel extrusion opening crossing at right angles according to the configuration of such invention according to claim 4 It becomes possible to suck a fuel out of fuel extrusion opening effectively to an airstream side with the inhalation-of-air negative pressure in a converging section. Airstream, while becoming possible to make the fuel sucked out collide mutually and to atomize a fuel more effectively and becoming possible to reduce fuel consumption -- exhaust air -- it becomes possible to improve description and engine power.

[0011]

[Embodiment of the Invention] Hereafter, it explains based on the example of this invention which showed the gestalt of operation of this invention to the attached drawing.

[0012] the notch side elevation in which drawing 1 - drawing 6 show the 1st example of this invention, and drawing 1 shows an engine inhalation-of-air system, and drawing 2 -- the enlarged vertical longitudinal sectional view of an inhalation-of-air way organizer, and drawing 3 -- the 3-3 line sectional view of drawing 2 , and drawing 4 -- a fuel supply pressure and exhaust air -- drawing and drawing 5 which show the relation of description -- fuel-injection timing and exhaust air -- drawing and drawing 6 which show the relation of description -- brake mean effective pressure and exhaust air -- it is drawing showing the relation of description.

[0013] In drawing 1 , a combustion chamber 15 is first formed between the piston 14 fitting of the sliding of is made free to the cylinder bore 13 with which Engine E is equipped with a cylinder block 11 and the cylinder head 12 combined with this cylinder block 11, and a cylinder

block 11 is equipped, and the cylinder head 12.

[0014] While the suction port 16 and the exhaust air port 17 which can be open for free passage to a combustion chamber 15 are established in the cylinder head 12, bearing of the closing motion actuation of the exhaust valve 19 which switches the free passage and cutoff between the inlet valve 18 which switches the free passage and cutoff between a suction port 16 and a combustion chamber 15, the exhaust air port 17, and a combustion chamber 15 is made possible, and the closing motion drive of an inlet valve 18 and the exhaust valve 19 is conventionally carried out by the well-known valve gear 20.

[0015] A fuel supply system 22 is connected to said suction port 16 through an inlet pipe 21. This fuel supply system 22 is equipped with the inhalation-of-air way organizer 23 and the fuel injection valve 24 with which this inhalation-of-air way organizer 23 is equipped.

[0016] In drawing 2 , the inhalation-of-air way organizer 23 consists of the inhalation-of-air way main formation member 26 which has a path 25, and the converging section material 27 which fitting is carried out to the downstream of said path 25, and is fixed to the inhalation-of-air way main formation member 26, and this inhalation-of-air way organizer 23 is equipped with the inhalation-of-air way 30 where a down-stream edge is opened for free passage by the inlet pipe 21 while an upper edge is opened for free passage by the air cleaner 29 through the inhalation-of-air hose 28. The inhalation-of-air way 30 consists of a part except the part to which fitting of the converging section material 27 is carried out, and a converging section 31 formed by the inside of the converging section material 27 among said paths 25, and rather than this converging section 31, a converging section 31 makes an inner circumference diameter small, the inhalation-of-air way 30 25, i.e., the path, of the upstream, and is formed.

[0017] Bearing of the throttle valve 32 of the butterfly form which controls the opening of the inhalation-of-air way 30 is carried out to the inhalation-of-air way main formation member 26 of the inhalation-of-air way organizer 23 rotatable by the upstream rather than said converging section 31.

[0018] While referring to drawing 3 collectively and establishing a circular sulcus in the periphery of the converging section material 27 It is equipped with the annular seal members 33 and 33 of the pair which faces across the circular sulcus from both sides. Between the converging section material 27 and the inhalation-of-air way main formation member 26, the annular fuel path 34 is formed in the inhalation-of-air way main formation member 26 of said circular sulcus in fitting and the condition

of having fixed, in the converging section material 27. The seal of the both sides of this fuel path 34 is carried out by the seal members 33 and 33 infixed between the inhalation-of-air way main formation member 26 and the converging section material 27. That is, the annular fuel path 34 which surrounds the inhalation-of-air way 30 to this alignment in the part corresponding to a converging section 31 is established in the inhalation-of-air way organizer 23.

[0019] The plurality 35, for example, four fuel extrusion openings, which carries out opening of the other end to the inside of a converging section 31 while making an end lead to the converging section material 27 to the fuel path 34, and 35 -- are those fuel extrusion openings 35 and 35. -- It is made counter mutually other end opening, made and prepared. And each fuel extrusion opening 35 and 35 -- are arranged in the flat surface which intersects perpendicularly with the axis of a converging section 31, and opening is carried out to the inside of a converging section 31 towards intersecting perpendicularly to the flow direction of airstream of each fuel extrusion opening 35 and 35 -- where the other end circulates a converging section 31.

[0020] In the inhalation-of-air way main formation member 26 in the inhalation-of-air way organizer 23, into the part corresponding to the converging section material 27 The minor diameter hole 37 which has an end wall 36 at an inner edge, and the bore hole 38 while being formed at a major diameter and making an inner edge stand in a row in the outer edge of the minor diameter hole 37 rather than this minor diameter hole 37 at the same axle, While being formed in a major diameter and making an inner edge stand in a row on the same axle in the outer edge of the inside bore hole 38 rather than the bore hole 38 in this, the major-diameter hole 39 which carried out opening of the outer edge is formed, and fitting of the color 40 of the shape of a closed-end cylinder which closed the inner edge is carried out to the minor diameter hole 37.

[0021] The point of a fuel injection valve 24 makes the annular seal member 41 intervene between the major-diameter holes 39, and is inserted in said inside bore hole 38 and the major-diameter hole 39. And fitting of the fuel jet nozzle 24a of the shape of a cylinder with which a fuel injection valve 24 is equipped at a tip is carried out to said color 40.

[0022] The bleeding room 42 is formed between fuel jet nozzle 24a and a color 40, and this bleeding room 42 is opened for free passage by the fuel path 34 through the free passage hole 43 prepared in the tip lock out section of a color 40, and the free passage hole 44 which made it this free passage hole 43 and the same axle, and was prepared in the end wall 36. And the annular seal member 45 is infixed among heel [of a

color 40], and fuel jet nozzle 24a, and the toe external surface of a color 40 is equipped with the annular seal member 46 which from-cartridge-contacts the inside of the minor diameter hole 37.

[0023] The annular crevice for forming the annular room 47 between the insides of the minor diameter hole 37 is established in the pars intermedia external surface of a color 40, and two or more free passage holes 48 and 48 -- which make between the annular room 47 and the bleeding room 42 open for free passage are prepared in a color 40.

[0024] In the upstream and this example, the air-bleed path 49 which makes an end lead to the inhalation-of-air way 30 makes that other end lead to said annular room 47 in the inhalation-of-air way main formation member 26 of the inhalation-of-air way organizer 23, makes it to it, and is prepared by the throttle valve 32 by the upstream, rather than said each fuel extrusion opening 35 and 35 -- at it, and an air jet 50 is pressed fit in the end section of this air-bleed path 49. That is, the other end of the air-bleed path 49 which made the inhalation-of-air way 30 of the upstream open an end for free passage through an air jet 50 rather than a throttle valve 32 is open for free passage to the fuel path 34 through the annular room 47, the free passage hole 48, 48 --, and the bleeding room 42 and the free passage holes 43 and 44.

[0025] Next, if an operation of this 1st example is explained, it will be mixed with the assistant air supplied from the air-bleed path 49, and it will be led to the fuel path 34, the fuel injected from a fuel injection valve 24 being measured with an air jet 50 in the bleeding room 42, and will be sucked out and atomized from each fuel extrusion opening 35 and 35 -- by the airstream which circulates the inhalation-of-air way 30 on the inhalation-of-air way 30. And the airstream which opening of each fuel extrusion opening 35 and 35 -- is carried out to the inhalation-of-air way 30 towards intersecting perpendicularly with the airstream which circulates the inhalation-of-air way 30, and circulates the inhalation-of-air way 30, By the fuel extrusion opening 35 and the fuel sucked out of 35 -- at an airstream side colliding mutually, a fuel being atomized effectively, and atomization of a fuel being promoted while becoming possible to reduce the fuel consumption of Engine E -- exhaust air -- it becomes possible to improve description and engine power.

[0026] Moreover, since the fuel extrusion opening 35 and 35 -- are carrying out opening to the inner skin of the inhalation-of-air way 30, the structure of the fuel extrusion opening 35 and 35 -- which bars flow is not established in the inhalation-of-air way 30 with arrangement. Therefore, increase of the ventilation resistance in the inhalation-of-

air way 30 can be avoided, and engine power can be improved further.

[0027] Since opening of the fuel extrusion opening 35 and 35 -- is furthermore carried out to the inner skin of the inhalation-of-air way 30 in the location which countered mutually By making the fuel extrusion opening 35 which countered mutually, and the fuels which were sucked out of 35 -- at the airstream side collide if a fuel can be atomized much more effectively and fuel consumption is reduced further, preventing that a fuel adheres to the inner skin of the inhalation-of-air way 30, while ** will become possible -- exhaust air -- description and engine power can be improved further.

[0028] Rather than this converging section 31, the converging section 31 which constitutes a part of especially inhalation-of-air way 30 makes an inner circumference diameter smaller than the inhalation-of-air way 30 of the upstream, and is formed in the inhalation-of-air way organizer 23. Since opening of the fuel extrusion opening 35 and 35 -- is carried out to the inner skin of a converging section 31 towards intersecting perpendicularly with the airstream which circulates a converging section 31 while the inhalation-of-air negative pressure in a converging section 31 enables it to suck out a fuel more effectively to an airstream side from the fuel extrusion opening 35 and 35 -- and becoming possible to reduce fuel consumption further -- exhaust air -- it becomes possible to improve description and engine power further.

[0029] exhaust air of the fuel supply system 22 according to such this invention, and the fuel supply system 22 only by the fuel injection from a fuel injection valve -- description If a fuel supply pressure is changed in the operational status of engine-speed 4000rpm and brake-mean-effective-pressure $P_{me}400kPa$ and being compared As opposed to description being acquired spraying which can hold down HC concentration in exhaust gas to about 180 ppm equivalent to the conventional carburetor even if it reduces the fuel supply pressure to a fuel injection valve 24 to near the 0kPa in the fuel supply system 22 which comes to show by drawing 4 and follows this invention -- In the fuel supply system 22 only by the fuel injection from a fuel injection valve, a fuel supply pressure is [250kPa(s)] lower limits. That is, to the ability not to fully atomize a fuel, if a fuel supply pressure is not set as 250 or more kPas, the fuel supply only by the fuel injection from a fuel injection valve enables it to fully atomize a fuel with the fuel supply system 22 according to this invention, even if it reduces a fuel supply pressure to near the 0kPa.

[0030] Therefore, while becoming possible to aim at miniaturization of the fuel pump connected to a fuel injection valve 24, and reduction of

power consumption, it becomes possible to aim at the cost cut of the fuel line prepared between a fuel injection valve 24 and a fuel pump. Moreover, a fuel is supplied for a fuel to a fuel injection valve 24 only by head ** from the fuel tank arranged above a fuel injection valve 24, without using a fuel pump, and you may make it measure a fuel by turning on and off of a fuel injection valve 24.

[0031] Thus, since a fuel can fully be atomized, it becomes it is possible to shorten the inhalation-of-air tube length from the inhalation-of-air path organizer 22 to a suction port 16, and possible to attain the miniaturization of the whole engine containing an inhalation-of-air system.

[0032] If a fuel injection valve 24 is the posture which can supply a fuel to the fuel path 34, the inhalation-of-air way organizer 23 may be equipped with it with what kind of posture, and it can increase the degree of freedom on arrangement of a fuel injection valve 24. However, if the inhalation-of-air way organizer 23 is equipped with a fuel injection valve 24 like this example with the posture which intersects perpendicularly with the axis of the inhalation-of-air way 30, the miniaturization of the whole engine which shortens an inhalation-of-air system and contains an inhalation-of-air system can be attained.

[0033] moreover, exhaust air of the fuel supply system 22 according to this invention, and the fuel supply system 22 only by the fuel injection from a fuel injection valve -- when fuel-injection timing (whenever [in front of OTDC / crank angle]) is changed in the operational status of engine-speed 4000rpm and brake-mean-effective-pressure Pme400kPa and description is compared, drawing 5 comes to show. even if it changes the injection timing of a fuel injection valve 24 in the fuel supply system 22 according to this invention so that clearly from this drawing 5 -- exhaust air -- the fuel supply system 22 according only to the fuel injection from a fuel injection valve to there being no change in description -- change of injection timing -- responding -- exhaust air - - description will change. namely, -- since a fuel injection valve 24 should just supply the fuel according to the amount sucked out by the inhalation-of-air way 30, even if a fuel is measured by the inhalation-of-air negative pressure according to the operational status of Engine E, and it is sucked out by the inhalation-of-air way 30, and it does not control the injection timing of a fuel injection valve 24 by the fuel supply system 22 according to this invention with high precision -- a fuel -- enough -- atomizing -- good exhaust air -- acquiring description -- possible -- **. however, in the fuel supply only by the fuel injection from a fuel injection valve, if fuel-injection timing is not

controlled with high precision, sufficient atomization of a fuel obtains -- not having -- exhaust air -- description will also get worse.

[0034] exhaust air of the fuel supply system 22 which furthermore follows this invention, and the fuel supply system 22 only by the fuel injection from a fuel injection valve -- when brake mean effective pressure P_{me} is changed and is measured, drawing 6 comes to show the operational status which considered the engine speed for description as low rotation of 2000rpm. the time of moreover Engine E being operated with the heavy load by low-speed rotation of 2000rpm with the fuel supply system 22 according to this invention, when brake mean effective pressure P_{me} is low so that clearly [in this drawing 6] -- a fuel -- enough -- atomizing -- good exhaust air -- the fuel supply according only to the fuel injection from a fuel injection valve to description being acquired -- a fuel -- enough -- it cannot atomize -- exhaust air -- degradation of description will be caused. That is, with the fuel supply system 22 according to this invention, since atomization by assistant air is also performed, the fuel can fully be atomized also by the heavy load and the operational status of low rotation.

[0035] By the way, it sets in the conventional engine which supplied the fuel using the fuel injection valve. According to it being difficult to provide fuel supply with one fuel injection valve over the large operation region from the idle opening of a throttle valve to full open opening, although an additional fuel injection valve may be arranged in the upstream rather than a throttle valve It is also possible to replace with and use the fuel supply system according to this invention for the fuel injection valve of the above-mentioned addition, and the 2nd following example explains the configuration of the inhalation-of-air system in such a case.

[0036] In drawing 7 , the fuel injection valve 52 which mainly provides the fuel which should be supplied to Engine E to the inlet pipe 53 connected to the suction port 16 of Engine E is attached, and an inlet pipe 53 is connected to an air cleaner 29 through a throttle body 51 and fuel supply system 22' equipped with a throttle valve 32.

[0037] Fuel supply system 22' is constituted like the fuel supply system 22 of the 1st example of the above except for a throttle valve not being prepared, and supplies the fuel of the part which run short only with the injection fuel quantity from said fuel injection valve 52.

[0038] In spite of according to this 2nd example replacing with an additional fuel injection valve and arranging fuel supply system 22' rather than a throttle valve 32 at the upstream, it is avoidable that inhalation-of-air resistance increases by that fuel supply system 22'.

[0039] Drawing 8 shows the 3rd example of this invention, the fuel supply system 22 which has a throttle valve 32 is connected to the suction port 16 of Engine E so that it may mainly provide the fuel which should be supplied to Engine E, and the additional fuel injection valve 54 is attached in the inhalation-of-air system between a throttle valve 32 and an air cleaner 29.

[0040] And the injection direction of the additional fuel injection valve 54 is set up in the direction corresponding to the center line of the converging section 31 in a fuel supply system 22.

[0041] According to this 3rd example, the fuel from the additional fuel injection valve 54 will be injected towards the fuel sucked out of each fuel extrusion opening 35 -- of the inner circumference of a converging section 31 by airstream in a fuel supply system 22, and it becomes possible to attain equalization of the concentration of the gaseous mixture when making a throttle valve 32 into high opening.

[0042] Drawing 9 shows the 4th example of this invention, and it is set up so that the injection direction of the additional fuel injection valve 54 may pass along the core of a part that each fuel extrusion opening 35 -- is prepared in the converging section 31 by this 4th example to the injection direction of the fuel injection valve 54 of the addition in the 3rd example of the above having been set up in the direction corresponding to the center line of a converging section 31.

[0043] According to this 4th example, as it is not interfered by the throttle valve 32, can make the injection fuel from the fuel injection valve 54 of an addition in the high opening condition of a throttle valve 32 able to collide with an extrusion fuel from each fuel extrusion opening 35 --, and a fuel is made to be able to distribute more effectively, and equalization of the concentration of gaseous mixture can be attained further.

[0044] As mentioned above, although the example of this invention was explained in full detail, this invention can perform various design changes, without deviating from this invention which is not limited to the above-mentioned example and indicated by the claim.

[0045]

[Effect of the Invention] while becoming possible to be able to make the airstream of an inhalation-of-air way, and the fuel sucked out of fuel extrusion opening at an airstream side able to collide mutually, to be able to atomize a fuel effectively, and to reduce fuel consumption as mentioned above according to invention according to claim 1 -- exhaust air -- it becomes possible to improve description and engine power.

[0046] Moreover, according to invention according to claim 2, increase

of ventilation resistance can be avoided and engine power can be improved further.

[0047] if a fuel can be atomized much more effectively and fuel consumption is reduced further, preventing that a fuel adheres to the inner skin of an inhalation-of-air way by making the fuels sucked out of fuel extrusion opening which countered mutually at the airstream side collide, while ** will become possible according to invention according to claim 3 -- exhaust air -- description and engine power can be improved further.

[0048] while becoming possible to become possible to suck a fuel out of fuel extrusion opening effectively to an airstream side with the inhalation-of-air negative pressure in a converging section according to invention according to claim 4, to make the airstream of a converging section, and the fuel sucked out collide mutually furthermore, and to atomize a fuel more effectively and becoming possible to reduce fuel consumption -- exhaust air -- it becomes possible to improve description and engine power.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the notch side elevation showing the inhalation-of-air system of the engine in the 1st example.

[Drawing 2] It is the enlarged vertical longitudinal sectional view of an inhalation-of-air way organizer.

[Drawing 3] It is the 3-3 line sectional view of drawing 2 .

[Drawing 4] a fuel supply pressure and exhaust air -- it is drawing showing the relation of description.

[Drawing 5] fuel-injection timing and exhaust air -- it is drawing

showing the relation of description.

[Drawing 6] brake mean effective pressure and exhaust air -- it is drawing showing the relation of description.

[Drawing 7] It is the notch side elevation showing the inhalation-of-air system of the engine in the 2nd example.

[Drawing 8] It is the notch side elevation showing the inhalation-of-air system of the engine in the 3rd example.

[Drawing 9] It is the notch side elevation showing the inhalation-of-air system of the engine in the 4th example.

[Description of Notations]

22 22' ... Fuel supply system

23 ... Inhalation-of-air way organizer

24 ... Fuel injection valve

29 ... Air cleaner

30 ... Inhalation-of-air way

31 ... Converging section

34 ... Fuel path

35 ... Fuel extrusion opening

49 ... Air-bleed path

E ... Engine

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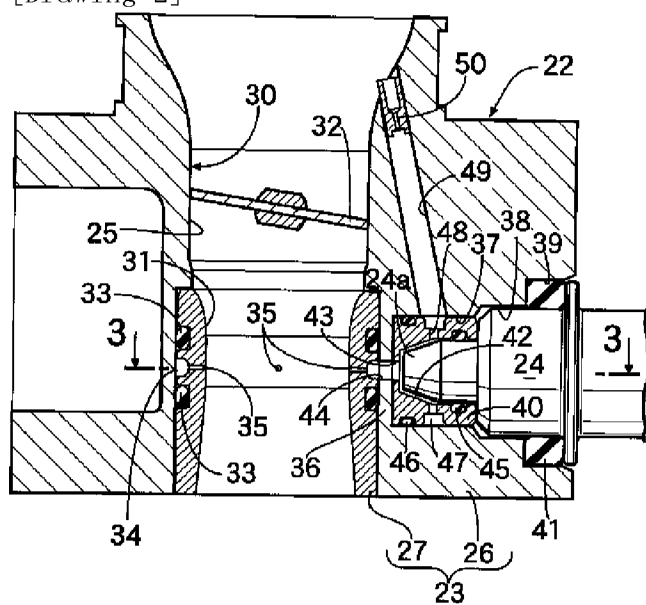
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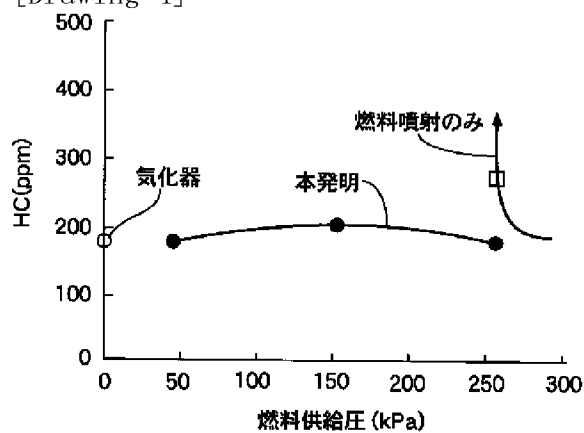
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DRAWINGS

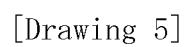
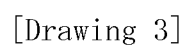
[Drawing 2]

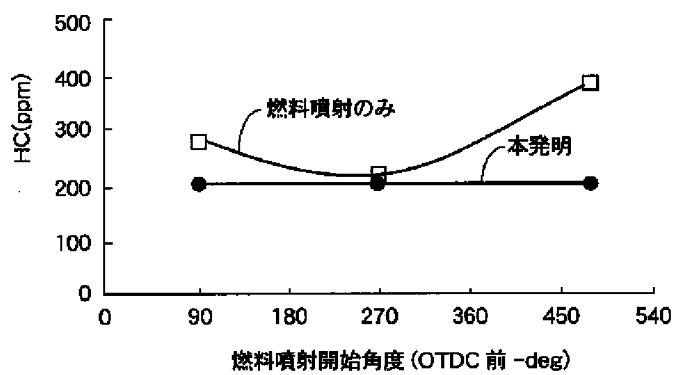


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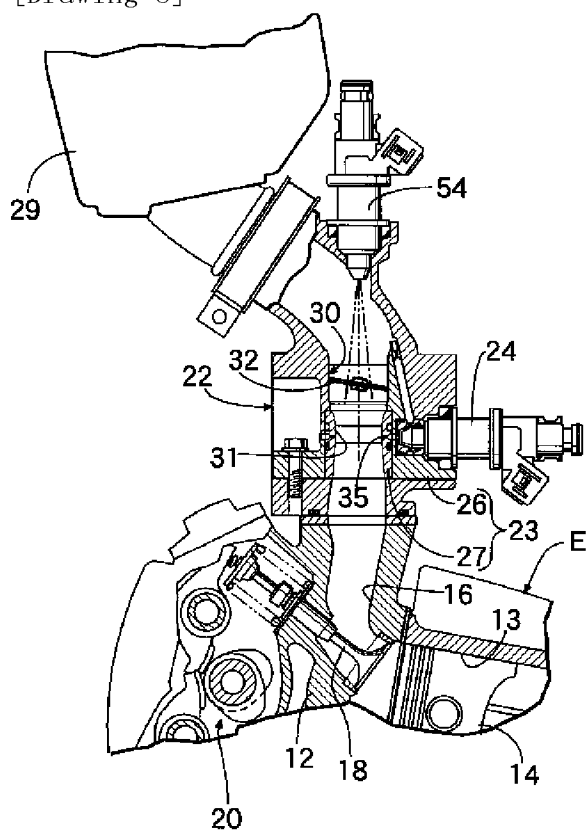


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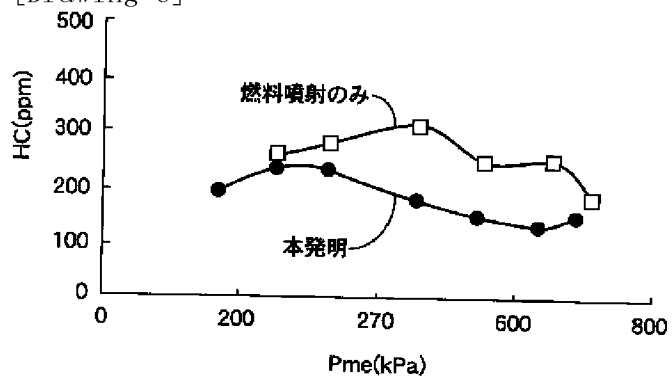




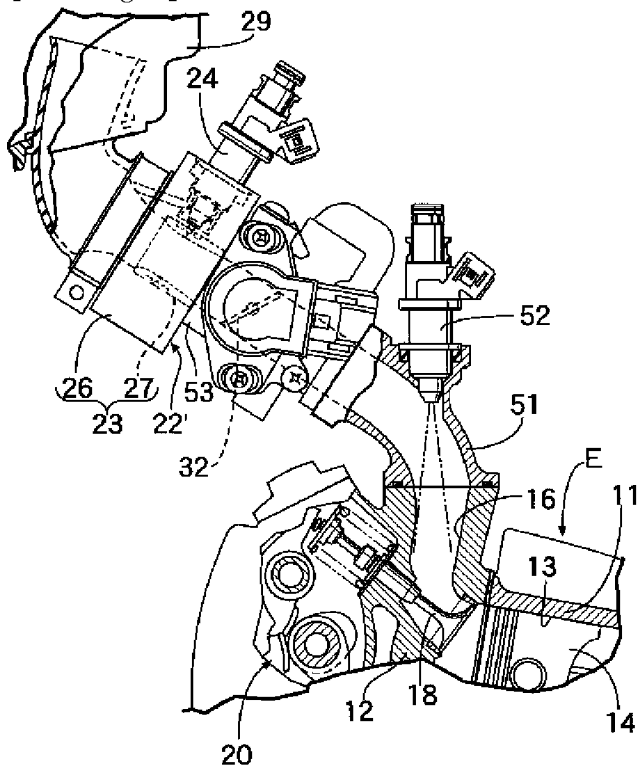
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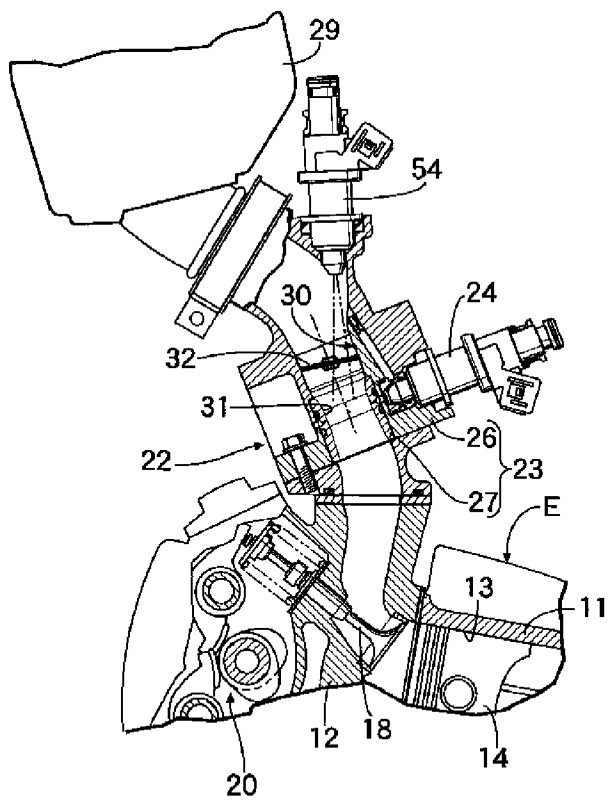
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[Drawing 7]



[Drawing 9]



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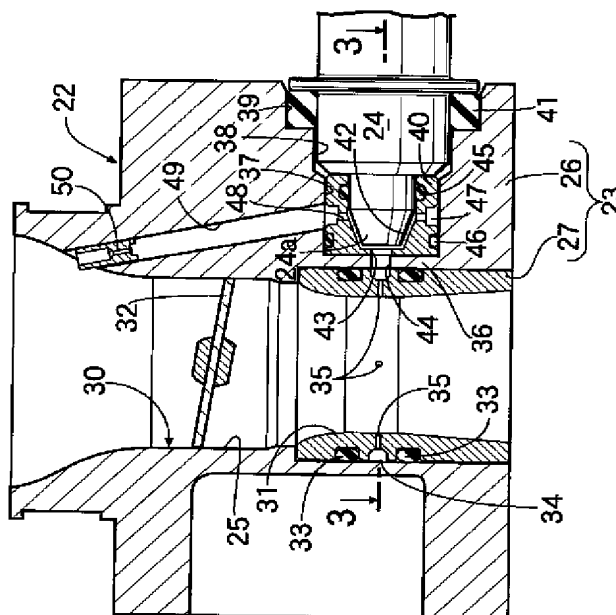
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(54)【発明の名称】 エンジンの燃料供給装置

(57)【要約】

【課題】吸気路を形成する吸気路形成体に燃料噴射弁が装着され、燃料噴射弁からの燃料が導かれる燃料通路と、燃料通路に一端を通じさせるとともに他端を吸気路に通じさせる燃料吸い出し口と、燃料吸い出し口よりも上流側で吸気路に一端を通じさせるとともに他端を燃料通路に通じさせたエアブリード通路とが、吸気路形成体に設けられるエンジンの燃料供給装置において、燃料の霧化をより一層促進する。

【解決手段】燃料吸い出し口35が、吸気路30を流通する空気流に直交する方向で吸気路30に開口される。



【特許請求の範囲】

【請求項 1】 エアクリーナ（29）に通じる吸気路（30）を形成する吸気路形成体（23）に燃料噴射弁（24）が装着され、前記燃料噴射弁（24）からの燃料が導かれる燃料通路（34）と、該燃料通路（34）に一端を通じさせるとともに他端を前記吸気路（30）に通じさせる燃料吸い出し口（35）と、前記燃料吸い出し口（35）よりも上流側で吸気路（30）に一端を通じさせるとともに他端を前記燃料通路（34）に通じさせたエアブリード通路（49）とが、前記吸気路形成体（23）に設けられるエンジンの燃料供給装置において、前記燃料吸い出し口（35）の他端が、前記吸気路（30）を流通する空気流に直交する方向で前記吸気路（30）に開口されることを特徴とするエンジンの燃料供給装置。

【請求項 2】 前記燃料吸い出し口（35）が吸気路（30）の内周面に開口して吸気路形成体（23）に設けられることを特徴とする請求項 1 記載のエンジンの燃料供給装置。

【請求項 3】 複数の前記燃料吸い出し口（35）の他端が、相互に対向した位置で前記吸気路（30）の内周面に開口されることを特徴とする請求項 2 記載のエンジンの燃料供給装置。

【請求項 4】 エアクリーナ（29）に通じる吸気路（30）を形成する吸気路形成体（23）に燃料噴射弁（24）が装着され、前記燃料噴射弁（24）からの燃料が導かれる燃料通路（34）と、該燃料通路（34）に一端を通じさせるとともに他端を前記吸気路（30）に通じさせる燃料吸い出し口（35）と、前記燃料吸い出し口（35）よりも上流側で吸気路（30）に一端を通じさせるとともに他端を前記燃料通路（34）に通じさせたエアブリード通路（49）とが、前記吸気路形成体（23）に設けられるエンジンの燃料供給装置において、前記吸気路（30）の一部を構成する絞り部（31）が、該絞り部（31）の上流側の吸気路（30）よりも内周直径を小さくして前記吸気路形成体（23）に設けられ、前記燃料吸い出し口（35）の他端が、前記絞り部（31）を流通する空気流に直交する方向で前記絞り部（31）の内周面に開口されることを特徴とするエンジンの燃料供給装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、エアクリーナに通じる吸気路を形成する吸気路形成体に燃料噴射弁が装着され、前記燃料噴射弁からの燃料が導かれる燃料通路と、該燃料通路に一端を通じさせるとともに他端を前記吸気路に通じさせる燃料吸い出し口と、前記燃料吸い出し口よりも上流側で吸気路に一端を通じさせるとともに他端を前記燃料通路に通じさせたエアブリード通路とが、前記吸気路形成体に設けられるエンジンの燃料供給

装置に関する。

【0002】

【従来の技術】従来、かかる燃料供給装置は、たとえば特開平 5-26132 号公報等で既に知られている。

【0003】

【発明が解決しようとする課題】ところで、このような燃料供給装置は、吸気路を流通する空気流で燃料噴射弁から供給される燃料を吸い出して霧化するとともに、エアブリード通路からのアシストエアで燃料の霧化を促進するようにしたものであり、燃料噴射弁の噴射圧を低下させることを可能とするとともに燃料噴射弁の燃料噴射タイミングを高精度に制御することを不要とするものである。しかるに、上記従来のものでは、燃料吸い出し口が、吸気路内の空気流の流れ方向下流側に向けて開口されており、空気流中での燃料の霧化が良好であるとはいえず、燃費の低減、排気性状の向上およびエンジン出力向上を図るために燃料の霧化をより一層促進することが望まれる。

【0004】本発明は、かかる事情に鑑みてなされたものであり、燃料の霧化をより一層促進し得るようにしたエンジンの燃料供給装置を提供することを目的とする。

【0005】

【課題を解決するための手段】上記目的を達成するために、請求項 1 記載の発明は、エアクリーナに通じる吸気路を形成する吸気路形成体に燃料噴射弁が装着され、前記燃料噴射弁からの燃料が導かれる燃料通路と、該燃料通路に一端を通じさせるとともに他端を前記吸気路に通じさせる燃料吸い出し口と、前記燃料吸い出し口よりも上流側で吸気路に一端を通じさせるとともに他端を前記燃料通路に通じさせたエアブリード通路とが、前記吸気路形成体に設けられるエンジンの燃料供給装置において、前記燃料吸い出し口の他端が、前記吸気路を流通する空気流に直交する方向で前記吸気路に開口されることを特徴とする。

【0006】このような請求項 1 記載の発明の構成によれば、燃料吸い出し口が吸気路の空気流と直交する方向で開口していることにより、空気流と、燃料吸い出し口から空気流側に吸い出される燃料とが相互に衝突して燃料が効果的に霧化されることになり、燃料の霧化が促進されることで、燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【0007】また請求項 2 記載の発明は、上記請求項 1 記載の発明の構成に加えて、前記燃料吸い出し口が吸気路の内周面に開口して吸気路形成体に設けられることを特徴とし、かかる構成によれば、燃料吸い出し口の配置に伴って吸気路内に流れを妨げる構造が設けられることがなく、通気抵抗の増大を回避することができ、エンジン出力をより一層向上することができる。

【0008】請求項 3 記載の発明は、上記請求項 2 記載

の発明の構成に加えて、複数の前記燃料吸い出し口他端が、相互に対向した位置で前記吸気路の内周面に開口されることを特徴とし、かかる構成によれば、相互に対向した燃料吸い出し口から空気流側に吸い出された燃料同士を衝突させることにより、燃料が吸気路の内周面に付着してしまうことを防止しつつ燃料をより一層効果的に霧化することができ、燃費をより一層低減するとが可能となるとともに、排気性状およびエンジン出力をより一層向上することができる。

【0009】さらに請求項4記載の発明は、エアクリーナに通じる吸気路を形成する吸気路形成体に燃料噴射弁が装着され、前記燃料噴射弁からの燃料が導かれる燃料通路と、該燃料通路に一端を通じさせるとともに他端を前記吸気路に通じさせる燃料吸い出し口と、前記燃料吸い出し口よりも上流側で吸気路に一端を通じさせるとともに他端を前記燃料通路に通じさせたエアブリード通路とが、前記吸気路形成体に設けられるエンジンの燃料供給装置において、前記吸気路の一部を構成する絞り部が該絞り部の上流側の吸気路よりも内周直径を小さくして前記吸気路形成体に設けられ、前記燃料吸い出し口他端が、前記絞り部を流通する空気流に直交する方向で前記絞り部の内周面に開口されることを特徴とする。

【0010】このような請求項4記載の発明の構成によれば、燃料吸い出し口が吸気路の空気流と直交する方向で絞り部の内周面に開口していることにより、絞り部での吸気負圧により燃料吸い出し口から空気流側に燃料を効果的に吸い出すことが可能となり、空気流と、吸い出される燃料とを相互に衝突させて燃料をより効果的に霧化することが可能となり、燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【0011】

【発明の実施の形態】以下、本発明の実施の形態を、添付の図面に示した本発明の実施例に基づいて説明する。

【0012】図1～図6は本発明の第1実施例を示すものであり、図1はエンジンの吸気系を示す切欠き側面図、図2は吸気路形成体の拡大縦断面図、図3は図2の3-3線断面図、図4は燃料供給圧および排気性状の関係を示す図、図5は燃料噴射タイミングおよび排気性状の関係を示す図、図6は正味平均有効圧力および排気性状の関係を示す図である。

【0013】まず図1において、エンジンEは、シリンダブロック11と、該シリンダブロック11に結合されるシリンダヘッド12とを備え、シリンダブロック11が備えるシリンダボア13に摺動自在に嵌合されるピストン14と、シリンダヘッド12との間に燃焼室15が形成される。

【0014】シリンダヘッド12には燃焼室15に連通可能な吸気ポート16および排気ポート17が設けられるとともに、吸気ポート16および燃焼室15間の連通

・遮断を切換える吸気弁18ならびに排気ポート17および燃焼室15間の連通・遮断を切換える排気弁19が開閉作動可能に支承されており、吸気弁18および排気弁19は、従来周知の動弁機構20で開閉駆動される。

【0015】前記吸気ポート16には吸気管21を介して燃料供給装置22が接続される。この燃料供給装置22は、吸気路形成体23と、該吸気路形成体23に装着される燃料噴射弁24とを備える。

【0016】図2において、吸気路形成体23は、通路25を有する吸気路主形成部材26と、前記通路25の下流側に嵌合されて吸気路主形成部材26に固定される絞り部材27とから成るものであり、この吸気路形成体23は、吸気ホース28を介してエアクリーナ29に上流端が連通されるとともに下流端が吸気管21に連通される吸気路30を備える。吸気路30は、前記通路25のうち絞り部材27が嵌合される部分を除く部分と、絞り部材27の内面で形成される絞り部31とで構成されるものであり、絞り部31は、該絞り部31よりも上流側の吸気路30すなわち通路25よりも内周直径を小さくして形成されている。

【0017】前記絞り部31よりも上流側で吸気路形成体23の吸気路主形成部材26には、吸気路30の開度を制御するバタフライ形のスロットル弁32が回動可能に支承される。

【0018】図3を併せて参照して、絞り部材27の外周には環状溝が設けられるとともに、その環状溝を両側から挟む一対の環状のシール部材33、33が装着されており、絞り部材27を吸気路主形成部材26に嵌合、固定した状態で絞り部材27および吸気路主形成部材26間には前記環状溝により環状の燃料通路34が形成され、該燃料通路34の両側は吸気路主形成部材26および絞り部材27間に介装されるシール部材33、33でシールされる。すなわち絞り部31に対応する部分で吸気路30を同心に圍繞する環状の燃料通路34が吸気路形成体23に設けられる。

【0019】絞り部材27には、燃料通路34に一端を通じさせるとともに絞り部31の内面に他端を開口させる複数たとえば4つの燃料吸い出し口35、35…が、それらの燃料吸い出し口35、35…の他端開口部を相互に対向させるようにして設けられる。しかも各燃料吸い出し口35、35…は、絞り部31の軸線に直交する平面内に配置されるものであり、各燃料吸い出し口35、35…の他端は、絞り部31を流通する空気流の流れ方向に対して直交する方向で絞り部31の内面に開口される。

【0020】吸気路形成体23における吸気路主形成部材26において絞り部材27に対応する部分には、内端に端壁36を有する小径孔37と、該小径孔37よりも大径に形成されて小径孔37の外端に内端を同軸に連なせた中径孔38と、該中径孔38よりも大径に形成さ

れて中径孔38の外端に内端を同軸に連なせるとともに外端を開口した大径孔39とが設けられており、小径孔37には、内端を閉じた有底円筒状のカラ−40が嵌合される。

【0021】燃料噴射弁24の先端部は、大径孔39との間に環状のシール部材41を介在させて前記中径孔38および大径孔39に挿入される。しかも燃料噴射弁24が先端に備える円筒状の燃料噴出ノズル24aは前記カラ−40に嵌合される。

【0022】燃料噴出ノズル24aおよびカラ−40間にはブリード室42が形成され、このブリード室42は、カラ−40の先端閉塞部に設けられた連通孔43と、該連通孔43と同軸にして端壁36に設けられた連通孔44とを介して燃料通路34に連通される。しかもカラ−40の外端部および燃料噴出ノズル24a間には環状のシール部材45が介装され、カラ−40の内端部外面には、小径孔37の内面に弾発接触する環状のシール部材46が装着されている。

【0023】カラ−40の中間部外面には小径孔37の内面との間に環状室47を形成するための環状凹部が設けられており、環状室47およびブリード室42間を連通させる複数の連通孔48、48…がカラ−40に設けられる。

【0024】吸気路形成体23の吸気路主形成部材26には、前記各燃料吸い出し口35、35…よりも上流側、この実施例ではスロットル弁32よりも上流側で吸気路30に一端を通じさせるエアブリード通路49が、その他端を前記環状室47に通じさせるようにして設けられており、該エアブリード通路49の一端部にはエアジェット50が圧入される。すなわちスロットル弁32よりも上流側の吸気路30にエアジェット50を介して一端を連通させたエアブリード通路49の他端は、環状室47、連通孔48、48…、ブリード室42および連通孔43、44を介して燃料通路34に連通する。

【0025】次にこの第1実施例の作用について説明すると、燃料噴射弁24から噴射される燃料は、ブリード室42内でエアジェット50で計量されつつエアブリード通路49から供給されるアシストエアと混合されて燃料通路34に導かれ、吸気路30を流通する空気流によって各燃料吸い出し口35、35…から吸気路30に吸い出されて霧化される。しかも各燃料吸い出し口35、35…は、吸気路30を流通する空気流に直交する方向で吸気路30に開口されており、吸気路30を流通する空気流と、燃料吸い出し口35、35…から空気流側に吸い出される燃料とが相互に衝突して燃料が効果的に霧化されることになり、燃料の霧化が促進されることで、エンジンEの燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【0026】また燃料吸い出し口35、35…が吸気路

30の内周面に開口しているので、燃料吸い出し口35、35…の配置に伴って吸気路30内に流れを妨げる構造が設けられることがない。したがって吸気路30での通気抵抗の増大を回避することができ、エンジン出力をより一層向上することができる。

【0027】さらに燃料吸い出し口35、35…が、相互に対向した位置で吸気路30の内周面に開口されているので、相互に対向した燃料吸い出し口35、35…から空気流側に吸い出された燃料同士を衝突させることにより、燃料が吸気路30の内周面に付着してしまうことを防止しつつ燃料をより一層効果的に霧化することができ、燃費をより一層低減すると可能となるとともに、排気性状およびエンジン出力をより一層向上することができる。

【0028】特に吸気路30の一部を構成する絞り部31が該絞り部31よりも上流側の吸気路30よりも内周直径を小さくして吸気路形成体23に設けられており、燃料吸い出し口35、35…が、絞り部31を流通する空気流に直交する方向で絞り部31の内周面に開口されるので、絞り部31での吸気負圧により燃料吸い出し口35、35…から空気流側に燃料をより効果的に吸い出すことが可能となり、燃費をより一層低減することが可能となるとともに、排気性状およびエンジン出力をより一層向上することが可能となる。

【0029】このような本発明に従う燃料供給装置22、ならびに燃料噴射弁からの燃料噴射のみによる燃料供給装置22の排気性状を、エンジン回転数4000rpm、正味平均有効圧力 P_{me} 400kPaの運転状態において燃料供給圧を変化させて比べると、図4で示すようになり、本発明に従う燃料供給装置22では燃料噴射弁24への燃料供給圧を0kPa近傍まで低下させても排気ガス中のHC濃度を従来の気化器と同等の180ppm程度に抑え得る噴霧性状が得られるのに対し、燃料噴射弁からの燃料噴射のみによる燃料供給装置22では燃料供給圧が250kPaが下限値である。すなわち燃料噴射弁からの燃料噴射のみによる燃料供給では、燃料供給圧を250kPa以上に設定しなければ燃料を十分に霧化し得ないのに対し、本発明に従う燃料供給装置22では燃料供給圧を0kPa近傍まで低下させても燃料を十分に霧化することが可能となるのである。

【0030】したがって燃料噴射弁24に接続される燃料ポンプの小型化および消費電力の低減を図ることが可能となるとともに、燃料噴射弁24および燃料ポンプ間に設けられる燃料配管のコストダウンを図ることが可能となる。また燃料ポンプを用いずに、燃料噴射弁24の上方に配置される燃料タンクからのヘッド圧だけで燃料を燃料噴射弁24に燃料を供給するようにし、燃料噴射弁24のオン・オフで燃料を計量するようにしてもよい。

【0031】このように燃料の霧化を充分に行なうこと

ができるので、吸気通路形成体22から吸気ポート16までの吸気管長を短縮することが可能であり、吸気系を含むエンジン全体の小型化を図ることが可能となる。

【0032】燃料噴射弁24は燃料通路34に燃料を供給し得る姿勢であればどのような姿勢で吸気路形成体23に装着されてもよく、燃料噴射弁24の配置上の自由度を増大することができる。但し、この実施例のように、吸気路30の軸線と直交する姿勢で燃料噴射弁24を吸気路形成体23に装着すれば、吸気系を短縮して吸気系を含むエンジン全体の小型化を図ることができる。

【0033】また本発明に従う燃料供給装置22、ならびに燃料噴射弁からの燃料噴射のみによる燃料供給装置22の排気性状を、エンジン回転数4000rpm、正味平均有効圧力 P_m 400kPaの運転状態において燃料噴射タイミング(OTDC前のクランク角度)を変化させて比べると、図5で示すようになる。この図5から明らかなように、本発明に従う燃料供給装置22では燃料噴射弁24の噴射タイミングを変化させても排気性状に変化がないのに対し、燃料噴射弁からの燃料噴射のみによる燃料供給装置22では噴射タイミングの変化に応じて排気性状が変化してしまう。すなわち本発明に従う燃料供給装置22では、燃料はエンジンEの運転状態に応じた吸気負圧によって計量されて吸気路30に吸い出されるものであり、燃料噴射弁24は、吸気路30に吸い出される量に応じた燃料を供給すればよいので、燃料噴射弁24の噴射タイミングを高精度に制御しなくとも燃料を十分に霧化して良好な排気性状を得ることが可能である。しかるに燃料噴射弁からの燃料噴射のみによる燃料供給では、燃料噴射タイミングを高精度に制御しなければ燃料の十分な霧化が得られず、排気性状も悪化してしまうのである。

【0034】さらに本発明に従う燃料供給装置22、ならびに燃料噴射弁からの燃料噴射のみによる燃料供給装置22の排気性状を、エンジン回転数を2000rpmの低回転とした運転状態において、正味平均有効圧力 P_m を変化させて比べると、図6で示すようになる。この図6で明らかなように、本発明に従う燃料供給装置22では、正味平均有効圧力 P_m が低いとき、すなわちエンジンEが2000rpmの低速回転でしかも高負荷で運転されているときに、燃料を十分に霧化して良好な排気性状が得られるのに対し、燃料噴射弁からの燃料噴射のみによる燃料供給では燃料を十分に霧化することができず、排気性状の劣化を招くことになる。すなわち本発明に従う燃料供給装置22では、アシストエアによる霧化も行なわれるので、高負荷、低回転の運転状態でも燃料を十分に霧化することができるのである。

【0035】ところで、燃料噴射弁を用いて燃料を供給するようにした従来のエンジンにおいて、スロットル弁のアイドル開度から全開開度までの広い運転域にわたって1つの燃料噴射弁で燃料供給をまかなうことが困難で

あることにより、スロットル弁よりも上流側に追加の燃料噴射弁を配設することがあるが、本発明に従う燃料供給装置を上記追加の燃料噴射弁に代えて用いることも可能であり、そのような場合の吸気系の構成を次の第2実施例で説明する。

【0036】図7において、エンジンEの吸気ポート16に接続される吸気管53には、エンジンEに供給すべき燃料を主としてまかなう燃料噴射弁52が取付けられ、吸気管53は、スロットル弁32を備えるスロットルボディ51および燃料供給装置22'を介してエアクリーナ29に接続される。

【0037】燃料供給装置22'は、スロットル弁が設けられないことを除いて上記第1実施例の燃料供給装置22と同様に構成されるものであり、前記燃料噴射弁52からの噴射燃料量だけでは不足する分の燃料を供給するものである。

【0038】この第2実施例によれば、追加の燃料噴射弁に代えてスロットル弁32よりも上流側に燃料供給装置22'が配置されるにもかかわらず、その燃料供給装置22'によって吸気抵抗が増加することを回避することができる。

【0039】図8は本発明の第3実施例を示すものであり、スロットル弁32を有する燃料供給装置22が、エンジンEに供給すべき燃料を主としてまかなうべくエンジンEの吸気ポート16に接続され、追加の燃料噴射弁54がスロットル弁32およびエアクリーナ29間の吸気系に取付けられる。

【0040】しかも追加の燃料噴射弁54の噴射方向は、燃料供給装置22における絞り部31の中心線に合致した方向に設定されている。

【0041】この第3実施例によれば、燃料供給装置22において絞り部31の内周の各燃料吸い出し口35…から空気流に吸い出される燃料に向けて追加の燃料噴射弁54からの燃料が噴射されることになり、スロットル弁32を高開度としたときの混合気の濃度の均一化を図ることが可能となる。

【0042】図9は本発明の第4実施例を示すものであり、上記第3実施例における追加の燃料噴射弁54の噴射方向が絞り部31の中心線に合致した方向に設定されていたのに対し、この第4実施例では、追加の燃料噴射弁54の噴射方向が絞り部31において各燃料吸い出し口35…が設けられている部分の中心を通るように設定される。

【0043】この第4実施例によれば、スロットル弁32の高開度状態で追加の燃料噴射弁54からの噴射燃料をスロットル弁32に邪魔されないようにして、各燃料吸い出し口35…からの吸い出し燃料に衝突させて燃料をより効果的に分散せしめ、混合気の濃度の均一化をより一層図ることができる。

【0044】以上、本発明の実施例を詳述したが、本発

明は上記実施例に限定されるものではなく、特許請求の範囲に記載された本発明を逸脱することなく種々の設計変更を行なうことが可能である。

【0045】

【発明の効果】以上のように請求項1記載の発明によれば、吸気路の空気流と、燃料吸い出し口から空気流側に吸い出される燃料とを相互に衝突させて燃料を効果的に霧化することができ、燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【0046】また請求項2記載の発明によれば、通気抵抗の増大を回避することができ、エンジン出力をより一層向上することができる。

【0047】請求項3記載の発明によれば、相互に対向した燃料吸い出し口から空気流側に吸い出された燃料同士を衝突させることにより、燃料が吸気路の内周面に付着してしまうことを防止しつつ燃料をより一層効果的に霧化することができ、燃費をより一層低減することが可能となるとともに、排気性状およびエンジン出力をより一層向上することができる。

【0048】さらに請求項4記載の発明によれば、絞り部での吸気負圧により燃料吸い出し口から空気流側に燃料を効果的に吸い出すことが可能となり、絞り部の空気流と、吸い出される燃料とを相互に衝突させて燃料をより効果的に霧化することが可能となり、燃費を低減することが可能となるとともに、排気性状およびエンジン出力を向上することが可能となる。

【図面の簡単な説明】

【図1】第1実施例でのエンジンの吸気系を示す切欠き側面図である。

【図2】吸気路形成体の拡大縦断面図である。

【図3】図2の3-3線断面図である。

【図4】燃料供給圧および排気性状の関係を示す図である。

【図5】燃料噴射タイミングおよび排気性状の関係を示す図である。

【図6】正味平均有効圧力および排気性状の関係を示す図である。

【図7】第2実施例でのエンジンの吸気系を示す切欠き側面図である。

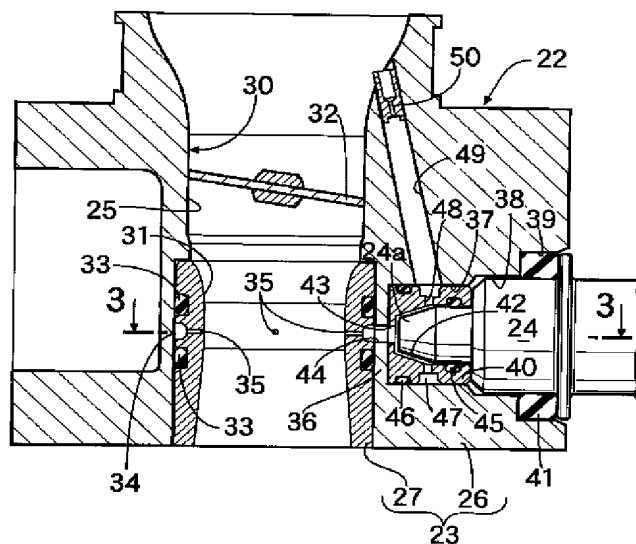
【図8】第3実施例でのエンジンの吸気系を示す切欠き側面図である。

【図9】第4実施例でのエンジンの吸気系を示す切欠き側面図である。

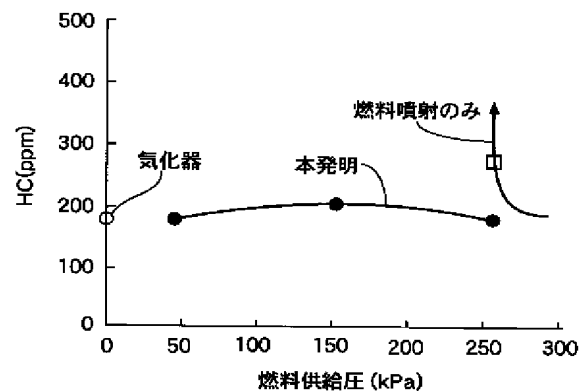
【符号の説明】

22、22'・・・燃料供給装置
23・・・吸気路形成体
24・・・燃料噴射弁
29・・・エアクリーナ
30・・・吸気路
31・・・絞り部
34・・・燃料通路
35・・・燃料吸い出し口
49・・・エアブリード通路
E・・・エンジン

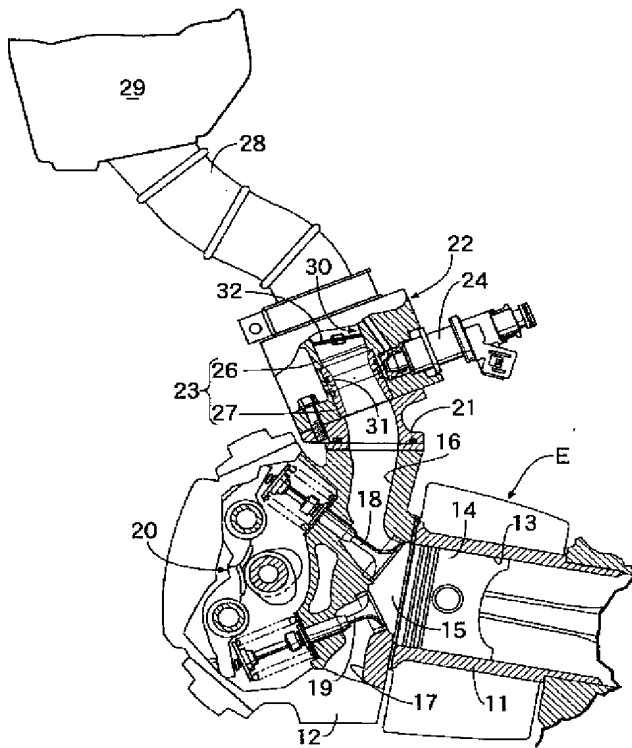
【図2】



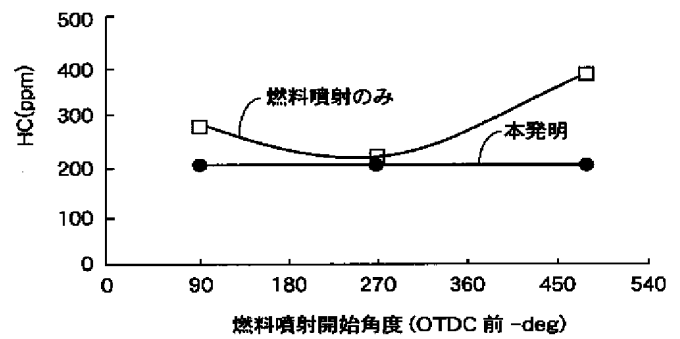
【図4】



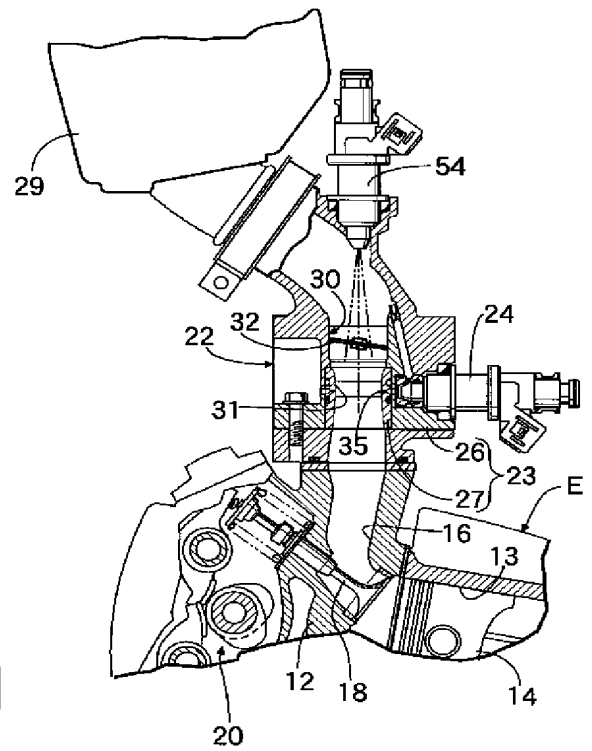
【図1】



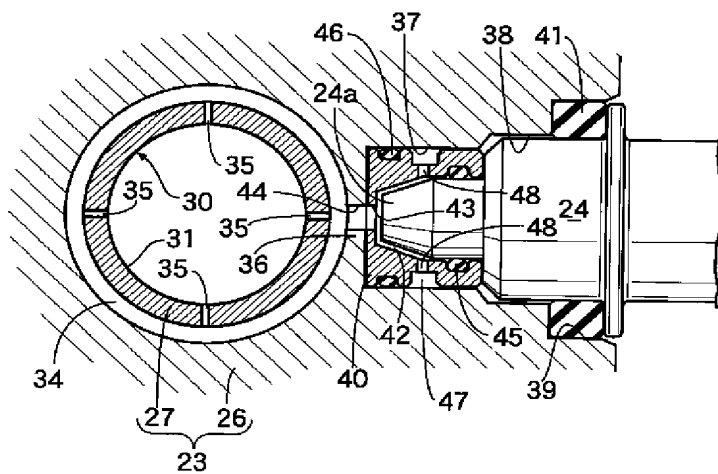
【図5】



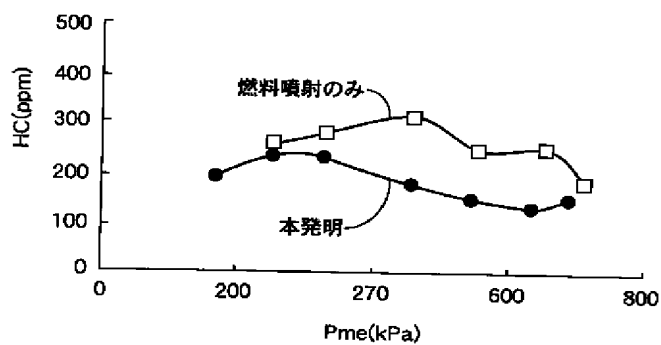
【図8】



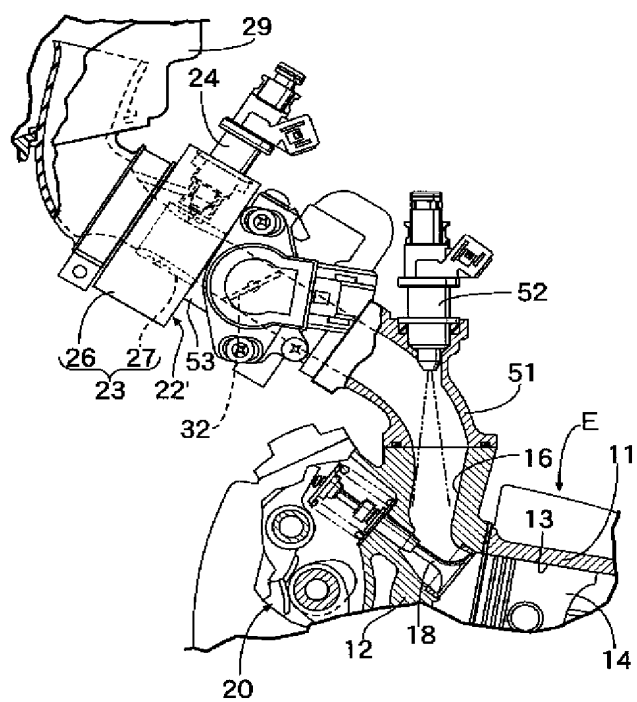
【図3】



【図6】



【図7】



【図9】

